

## **CORRELATION-EXTREME NAVIGATION SYSTEM BASED ON MORPHOLOGICAL ANALYSIS**

*Relevance of research topic* is caused by the fact that the comparison of images based only on the brightness characteristics is not sufficient sometimes, but morphological comparison considers also geometric characteristics.

*Purpose of research* is to disclose the principle of work and efficiency of Correlation-Extreme Navigation System (CENS) based on morphological analysis.

Unmanned Aerial Vehicles (UAVs) always contains Global Positioning System (GPS) and Inertial Measurement Unit (IMU). It usually has the ability to perform automatic navigation along planned waypoints. Nevertheless, if the GPS signal becomes unavailable, the state estimation solution provided by data from IMU alone drifts in time and will be unusable. Correlation-extreme navigation is one of alternative solution in such case and may be additional source of data fusion in the integrated navigation complex.

The principle of CENS operation is based on a comparison of image of the Earth's surface or current image and reference one received in advance. The core problem of modern image analysis is the need to consider the probabilistic nature of the real image, to account a priori information, to ensure the robustness of image analysis procedures with respect to various kinds of noise.

Images of the same scene may significantly differ from each other during varying the conditions of their registration, such as lighting, optical properties of the object surface, characteristics of the environment, etc. This fact complicates the scenes analysis by their images, because the relationship between the location of objects and distribution of brightness in the field of view is mixed.

However, if all sorts of images of the scene can be described by a certain class of transformations carried out over a certain image of the scene, then it is natural to consider the maximal invariant of the class of transformations as the characteristic of objects shapes in the image.

Since this invariant usually not restore objects form, it is called a form of image, and image analysis methods, based on this idea, are called morphological ones.

Suppose there are two images of some area and objects thereon, obtained in winter and summer. Let it is necessary to distinguish object, which is absent on one image but distinguishable on the other. The difficulty lies in the fact that a change in the conditions of registration leads to changes in the image, which is often more important than the appearance/disappearance of objects in some area. Morphological methods can successfully cope with this task. Analysis shows that the difference in the registration conditions leads to substantial differences in brightness. But it is possible to find morphological difference of the same